DEPARTMENT OF HEALTH AND SOCIAL SECURITY

Reports on Public Health and Medical Subjects

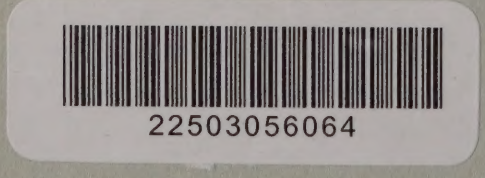
No. 126

Report of the Working Party on the Organisation of Radioactive Isotope Services

LONDON

HER MAJESTY'S STATIONERY OFFICE

PRICE 2s 6d [12½p] NET



DEPARTMENT OF HEALTH AND SOCIAL SECURITY

Reports on Public Health and Medical Subjects
No. 126

Report of the Working Party on the Organisation of Radioactive Isotope Services

LONDON
HER MAJESTY'S STATIONERY OFFICE
1970

SBN 11 320183 4

CONTENTS

PREFACE

The use of radioactive isotopes in medicine is now widespread and presents problems of organization both for the provision of services to patients and the safety of patients and staff. An expert group under the Chairmanship of Sir Brian Windeyer was therefore asked to advise on the organization and development of these services. This report is the result of their intensive work.

I record with gratitude our great indebtedness to Sir Brian Windeyer and his colleagues for the time and expert knowledge that made this detailed report possible.

The report will be a useful guide to hospital authorities when considering the development of radioactive isotope services. The recommendations it contains should be read in the light of proposals put forward in the recently published Second Green Paper on "The Administrative Structure of the Medical and Related Services in England", the report of the Committee on the Functions of the District General Hospital, published in 1969, and the report of the Committee on Hospital Scientific and Technical Services, published in 1968.

G. E. GODBER

ACKNOWLEDGMENT

from Professor Sir Brian Windeyer to
Sir George Godber

I have pleasure in submitting to you the report of the Working Party on the Organization of Radioactive Isotope Services which you set up under my chairmanship in November 1966, "to consider the development and organization of work involving the use of radioactive isotopes in the National Health Service and to make recommendations." In compiling this report the Working Party has taken account of the advice of the following professional organizations:

Royal College of Physicians
Royal College of Surgeons
Royal College of Obstetricians and Gynaecologists
Faculty of Radiologists
British Institute of Radiology
Nuclear Medicine Society
Hospital Physicists Association
College of Pathologists
Association of Clinical Biochemists

I should like to record the appreciation of the Working Party of the help given by the Secretaries: the late Dr. M. J. T. Adams, Dr. E. A. Lennon, Mr. R. P. S. Hughes and Mr. E. L. McMillan, and other officers of the Department of Health and Social Security who attended meetings and helped us with our work.

WORKING PARTY ON THE ORGANIZATION OF RADIOACTIVE ISOTOPE SERVICES

Members of the Working Party

Professor Sir Brian Windeyer, F.R.C.P, F.R.C.S, F.F.R.
J. W. D. Bull Esq., M.A, M.D, F.R.C.P, F.F.R.
Miss Barbara Clayton, M.D, M.R.C.P, Ph.D.
R. E. Ellis, Esq., B.Sc, Ph.D.
C. W. Gilbert, Esq., M.A, B.Sc, Ph.D.
R. Glyn Thomas, Esq., M.B, Ch.B, M.R.C.S, L.R.C.P, D.P.H.
W. A. Little, Esq., M.P.S.
T. Lodge, Esq., M.B, Ch.B, F.R.C.P, F.R.C.S, F.F.R.
A. S. McFarlane, Esq., M.A, M.B, B,Sc, Ch.B.
Professor J. Mitchell, C.B.E, D.Sc, M.D, F.R.S, D.M.R, F.F.R.
E. E. Pochin, Esq., C.B.E, M.D, F.R.C.P.
N. G. Trott, Esq., B.Sc, Ph.D, F.Inst.P.
R. F. Welch, Esq., M.D, F. C. Path.
E. S. Williams, Esq., B.Sc, M.B, B.S, Ph.D, A.Inst.P.

Joint Secretaries

M. J. T. Adams, Esq., M.D, B.S, D.M.R.T. (deceased July 1968).
E. A. Lennon, Esq., M.B, B.S, F.F.R.
R. P. S. Hughes, Esq.
E. L. McMillan, Esq., C.B.E, A.F.C.

Terms of Reference

To consider the development and organization of work involving the use of radioactive isotopes in the National Health Service, and to make recommendations.

1. Introduction

1.1. The Working Party was appointed in November 1966 "to consider the development and organization of work involving the use of radioactive isotopes in the National Health Service, and to make recommendations". It was evident to the Working Party that many of the problems to which it had to direct attention arose largely in connection with medical applications of the radioisotopes of particular elements incorporated into molecules of pharmacological interest. It was decided, therefore, to read the terms of reference as directing the Working Party to consider the use in the National Health Service as radioactive materials in general.

1.2. There are some problems in terminology. The term "radionuclide" applies to a radioactive species such as ^{32}P or ^{131}I. If a radionuclide is incorporated in a product of pharmaceutical interest, this product is called a radiopharmaceutical. The words "isotope" and "radioisotope" are commonly used throughout the world as nouns and adjectives in describing radionuclides, radiochemicals and radiopharmaceuticals as well as many of the procedures and laboratories involving these substances. It is suggested that, as far as possible, the words "isotope" and "radioisotope" should be applied only in their original sense to specify nuclides of differing mass but the same atomic number. Provided no ambiguity can arise there do not, however, seem to be strong grounds for resisting the (at present almost universal) use of terms such as "radioisotope laboratory" or "clinical radioisotope measurements". They are convenient and virtually have become part of the general language, and no serious misunderstanding can arise. It is, however, important not to describe as radioisotopes those radiopharmaceuticals which are used in scintillation scanning, since here precision in terminology is important to an understanding of processes taking place.

1.3. The use of unsealed radioactive isotopes for medical purposes began in this country in the late 1940s. Since then their use has expanded greatly. Most of this expansion has been in diagnostic applications and it has been most rapid in the last 10 years. A survey carried out in 1964 by the Ministry of Health (as it was then) showed that radioisotopes were being used for diagnostic purposes in 125 hospitals and for therapy in 80 hospitals, the latter being mostly among the 125. Diagnostic applications served almost every branch of medical practice.

1.4. The 1964 survey showed substantial variation in the way a radioisotope service was organized in different hospitals. It was generally the responsibility either of the Department of Medical Physics or of the Department of Radiotherapy, but there were hospitals in which the Departments of Pathology, Medicine or Diagnostic Radiology organized it. A few hospitals had Departments of Nuclear Medicine headed by medical consultants in this field (some other such departments are planned at the time of writing).

1.5. In May 1967 in an effort to obtain fuller information about the organization of radioisotope services within hospitals, our Chairman sent to 24 selected departments which were using radioisotopes a questionnaire seeking information about a large number of aspects of their radioisotope service. The departments were selected as far as possible to give a representative picture of isotope departments of various types and sizes. Twenty-one hospitals (one in collaboration with its medical school) and two units of the Medical Research Council

were able to provide us with information. We imposed an onerous task on those to whom we sent the questionnaire and we are most grateful for the information they provided, which greatly helped us in reaching our conclusions.
1.6. The findings of our survey confirmed generally the pattern of inconsistency in the organization of radioisotope services which was already known to the Ministry of Health (now the Department of Health and Social Security) and to us as individuals; this followed inevitably from the absence up to the present time of any generally accepted guidelines in the organization of this developing area of medicine and was the main reason why a working party on the subject was necessary.

2. Co-ordinated planning of radioisotope services

2.1. The scale on which the use of radioisotopes has expanded in recent years is very largely a reflexion of their usefulness in diagnosis. Probably consultants in most disciplines could with advantage to their patients make some use of them. It must therefore be considered how radioisotopes can be made available as widely as they can be usefully employed, subject to the adequacy of resources and the competing claims of other developments. If the various elements of a radioisotope service are not organized in the most efficient way possible the service will be less complete than it might have been and resources will be wasted. The contribution to and need for the radioisotope service of the departments mentioned in the previous section as having responsibility for the service in various places (medical physics, radiotherapy, pathology, medicine and diagnostic radiology) must be evaluated with the aim of finding arrangements which will both satisfy the local need and make effective use of their contribution.
2.2. There are no universally valid answers to such questions and many decisions about the organization of radioisotope services will have to be taken in the light of local circumstances. Certain criteria are clear and we hope that our proposals will lead to the establishment of a framework within which the answers to many questions about radioisotope services will suggest themselves more readily than they do at present.
2.3. So many different disciplines are involved in the clinical use of radioisotopes that it is not easy to give guidance on how the service should be best organized. Not only are radiologists (both diagnostic and therapeutic) involved, but specialists in endocrine diseases, haematology and metabolic disease are also concerned. Besides this, a supporting staff of non-medical workers is required—physicists, biochemists, medical laboratory technicians, radiographers and physics technicians. It is a function of the medical men involved to translate the findings into clinical terms.
2.4. A great deal of scientific equipment is required, much of it very expensive. In our questionnaire we sought information about the use being made of equipment in relation to its capacity. In the event definitions of "capacity" differed too widely to allow us to draw any statistical conclusions about the use of equipment, but it seemed clear that most of it was being operated well below capacity. As we state in Section 3 below, we think that there is considerable potential demand for tests employing radioisotopes which is still unmet. The co-existence at present of unused capacity and unmet need underlines the importance of deploying resources so that they are used to the best possible effect.

2.5. The planning of a service must also cover the problems of supply and storage of radioisotopes and the need to ensure safety in their use. Because of their price structure bulk purchase of radioisotopes is often more economical than the repeated purchase of small amounts, and the possibility of achieving savings through bulk purchase must clearly influence the planning of a service. Storage requires special precautions against radiation hazards and the actual dispensing of radioisotopes must also be carefully controlled to ensure that the correct doses are given. There must be adequate support by physicists, biochemists and pharmacists for these purposes.

2.6. These are the main factors which in our view should influence the planning of radioisotope services. Up to now, in the absence of co-ordinated guidance, the development of a service has inevitably been directed to a great extent by local interest and the local availability of resources. We see it as our primary task to consider how a service can be brought into a closer relationship with the need for it.

2.7. Increasing numbers of District general hospitals are now being planned and it is important to have a clear idea of the provision for radioisotope services which should be made in them. From this point of view our recommendations will have to be read in the context of two other reports—those of the Committee on Hospital Scientific and Technical Services (the Zuckerman Report) and, being prepared at the time of writing, the Committee of the Central Health Services Council on the Functions of the District General Hospital.

3. The radioisotope services of the future

3.1. In this section we attempt to estimate the need for radioisotope services in the near future and give our views on how they should be deployed among different hospitals to meet it. Our recommendations on the organization of a service within hospitals are given in Sections 4 and 5.

3.2. Future demand for a radioisotope service is very difficult to judge, and any forecast must contain an element of guesswork. But a service cannot be planned without some conception of the level of future need. A radioisotope service in a hospital requires considerable fixed capital investment in the form of building and equipment. Buildings used for this purpose must satisfy certain special requirements which we discuss in Section 4. It will generally be desirable for them to be purpose-built, and decisions about radioisotope services will thus have to be taken at an early stage in the planning of a hospital and related to some estimate of future need. Pending such developments there may be a case for housing equipment in existing service departments.

3.3. Among factors which are relevant to a view of future demand are the extent of unmet need at present and the likely rate of technical advance leading to the introduction of new tests. Demand will also be influenced by the ease with which tests can be made available; this is something which will be affected by our recommendations and if they are accepted it will be increased. Demand will be further influenced by the degree to which tests prove rewarding in the management of patients. But these are not exactly definable quantities; furthermore it is almost impossible to estimate the demand for a particular test until it has been made readily available. Taking first the unmet need, we think that many patients who do not at present undergo any tests could benefit from doing

so. It is important that clinicians should be fully aware of the ways in which radioisotopes may help them in treating their patients and we hope that our proposals will lead to a situation in which this knowledge is more widespread than at present.

3.4. There is no reliable way of predicting the direction or rate of future technical advance. But on the assumption, which we think justified, that there is still substantial unmet demand for the existing diagnostic uses of radioisotopes, we consider that the rate of expansion in recent years gives some guide at least to the general order of future demand which is to be expected. The Radiochemical Centre have given us information about the quantities of radioisotopes supplied in recent years to hospitals in the United Kingdom. In the period from 1963/64 to 1967/68, while shipments of those radioisotopes used mainly in therapy remained fairly constant, the quantity supplied annually of isotopes used mainly in diagnosis (measured in millicuries) has increased almost sevenfold. Individual consignments have tended to become larger and the number of consignments of these radioisotopes has increased by about 50 per cent in the same period. The correlation between the quantities of radioisotopes supplied and the amount of work done is not entirely certain, but we have little doubt that the increase in the quantity supplied reflects substantial growth—though not necessarily of the same order—in the amount of work in which radioisotopes were used. There are no signs as yet of the rate of growth diminishing and we have assumed in making our recommendations that there will continue to be a rapid expansion at least for the next few years. We suggest that the scale of the use of radioisotopes will have to be kept under review so that from time to time predictions of need in subsequent years can be formulated.

3.5. Demand of the order we think likely implies wide availability of radioisotope services, particularly when the multiplicity of diagnostic uses is remembered. But the need for economy and efficiency points to a measure of centralization so that equipment and staff are fully employed. A further argument for centralization which will sometimes apply is the need at the level where research and development are carried out to have a professional team large enough to generate the necessary cross-fertilization of ideas. There is clearly a potential conflict between the demand for widespread services and the claims of efficiency, but we think that in practice it will be possible to establish widely distributed services in which certain activities are centralized within the region. We therefore consider the provision of radioisotope services at two main levels, the Regional centre and the District general hospital. At present District general hospitals or their equivalents do not exist everywhere, and we therefore consider also a third level, the smaller hospital.

3.6. We think that in each regional area the focal point of the radioisotope services should be the Regional radioisotope centre. There might be around 20 such regional centres in England and Wales, each serving a population of some 2 million, which means that the more heavily populated of the present hospital regions might have more than one centre; although geographical and administrative circumstances would also be relevant in determining this. A Regional centre would be responsible for specialized training in radioisotope work of the medical, scientific and technical staff engaged in providing services throughout the region. Its senior staff would give guidance on the regional planning of the service provided both by the regional centre itself and in the District general hospitals. It would provide specialized services and would have,

in addition to the normal equipment of a radioisotope service, those expensive items of equipment which it would not be economically justifiable to provide at district level. A Regional centre would undertake research and development work which might well be associated with the work of a university clinical department or departments. We think that ideally it should be located in a teaching hospital but it might possibly be in a large District general hospital which had all the necessary facilities.

3.7. We discuss some aspects of a Regional centre's training function in Sections 5 and 6. Training programmes should be worked out in co-operation with the appropriate academic bodies. Where a Regional centre is in a teaching hospital we would expect there to be university staff working in it who will often be able to make an important contribution to training.

3.8. Overall planning of radioisotope services, as of other hospital services, is of course the responsibility of Regional Hospital Boards. We think that Senior Administrative Medical Officers, when formulating their advice to boards on the planning of radioisotope services, should consult closely with the consultants in charge of the Regional radioisotope centres and with other appropriate senior staff, including in particular university staff. Expert knowledge will thus be brought to bear on the overall deployment of the services and on such questions as the location of items of equipment which it is not practicable to put in all District general hospitals. The precise method of consultation will be a matter for local decision; there may well be advantages in establishing some form of regional advisory committee to advise on this subject. Teaching hospitals and their associated medical schools will be playing a central part in developing the services, so that co-operation between Boards of Governors and Regional Hospital Boards and the universities will be important.

3.9. Apart from the relatively formal process of consultation about regional planning, there will naturally be informal consultation between the Regional centres and those responsible for the radioisotope services in the District general hospitals on the many problems to which the greater expertise of the regional centres may be able to suggest a solution.

3.10. Some specialized clinical work would be excluded from the routine services provided by the District general hospitals and would be done exclusively in the regional centres. The work in this category would essentially comprise those tests which are not yet fully established but are being developed in association with the basic research of universities, and those which involve the use of expensive equipment not available in the district centres. As tests become established they would be included in the services provided by the District hospitals and the nature of the work done exclusively in the Regional centres would change gradually as frontiers in this area were pushed forward.

3.11. We would expect radiological protection advisers (who are sometimes appointed regionally) to advise the Regional radioisotope centres on radiological protection problems which are peculiar to the field of radioisotopes. *The Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use* covers this subject and should be the guide for all users of radioactive isotopes. A Regional centre should be prepared to offer advice to clinicians in its region on their applications to the Isotope Advisory Panel of the Medical Research Council for the approval of clinical projects.

3.12. We think that there will often be economic advantages in arranging the

ordering, dispensing and distribution of radioisotopes on a regional basis, and in Section 8 we put forward an outline scheme for this.

3.13. We think that District general hospitals will be a setting in which an efficient radioisotope service undertaking all except the most specialized work can be developed. We recommend that there should be a radioisotope service in every District general hospital and that there should be provision for this in the planning of such hospitals. We would expect the District general hospital radioisotope service to undertake a range of routine *in vivo* and *in vitro* tests including organ scanning. A regional centre would also provide this district service for its immediate area.

3.14. Service at the third level, which we have called "the smaller hospital", will be needed in places where District general hospitals do not yet exist. Generally we would expect the activity of radioisotope units at this level to be restricted to routine tests, although the precise nature of such services would depend on the degree of development of the various medical specialties in the hospital concerned. There is no reason why, if the necessary facilities can be made available, one of these hospitals should not provide a radioisotope service for a population equivalent to that covered by a District general hospital, and serve patients from other hospitals in the area, but in such cases we should regard the service as being essentially the same as a District general hospital service. The provision of a service will not be justifiable in all the smaller acute hospitals and some such hospitals will not necessarily have any radioisotope facilities at all but will obtain them from the nearest District hospital radioisotope service.

3.15. It will be apparent that these recommendations are framed in the context of the present system of hospital administration. The Green Paper on "The Administrative Structure of the Medical and Related Services in England and Wales" (published in 1968) proposed, as a basis for public discussion and consultation with representative bodies, that this system should be changed and that the National Health Service authorities in England and Wales, viz Regional Hospital Boards, Hospital Management Committees, Boards of Governors and Executive Councils, should be replaced by a single tier of area authorities, possibly numbering forty to fifty in all and each responsible for all health services in its area. We understand that as a result of widespread discussions the Department is now working on proposals for a two-tier system with a larger number of lower tier authorities and a smaller number of regional tier authorities. If a system of this kind is established the new regional tier authorities might take over responsibility for the overall planning on which we have suggested that senior administrative medical officers should consult with the proposed regional centres. We think that, whatever the authority responsible for this overall planning, there will be the same need for consultation with the regional centres on matters relating to the radioisotope service. Provided the size and boundaries of the new administrative regions do not differ markedly from those of the present RHB's we think the radioisotope service we propose could be related without much difficulty to the new administrative structure. Much however depends on the precise shape of structure eventually adopted.

3.16. Because diagnostic applications of radioisotopes present more serious organizational problems than do their therapeutic uses we have concerned ourselves primarily with the use of radioisotopes in diagnosis. We recognize, however, that in so far as the two have needs in common, and providing that the

diagnostic use of radioisotopes is not adversely affected, there will often be advantages in departments using radioisotopes for therapeutic purposes sharing facilities—particularly laboratory facilities—with diagnostic users.

3.17. Our proposals on the overall organization of radioisotope services are not intended to produce a closed and inflexible system. Variation and experiment have an important part to play in the development of these services. Moreover, we do not regard the relationship between Regional centres and District hospital services as immutable, even in the context of the present National Health Service administrative structure. If, for example, there is a hospital centre already providing an extensive radioisotope service to a small population there may well be a case for the District general hospitals in the area to have a role in relation to the use of radioisotopes somewhat more restricted than that envisaged in this report in general.

4. Organization within hospitals

4.1. Before we turn to the special problems of the different types of radioisotope service proposed in Section 3, we think it will be helpful to put forward some guide lines which are of general application and which should in our view influence the planning of any type of radioisotope service. These guide lines may be divided broadly into those relating to staff and those relating to accommodation. They do not in themselves constitute definite proposals, but rather indicate some of the principles on which are based the proposals which we later make for different types of radioisotope service.

4.2. Firstly, we think that the radioisotope service in any hospital should be based on centralized accommodation including laboratory space, scanning rooms, equipment and storage space. In our view, this will be the most efficient arrangement for most purposes because in this manner duplication of effort should be avoided and radiological protection aspects should present fewer problems. Where a hospital has centralized laboratory facilities, with pathology, biochemistry and haematology grouped together, we think there will be a strong case for making the radioisotope service part of this complex. It should be remembered that *the Code of Practice for the Protection of Persons against Ionizing Radiations arising from Medical and Dental Use* states that "As far as possible, laboratories should be set aside for radioactive work and should not be used for other purposes". If radioisotope work involves activities above a very low level, separate facilities will be needed, although the laboratory could still be part of the centralized complex.

4.3. This is the arrangement we think most appropriate for those parts of a radioisotope service whose application is to a number of clinical fields. At present, some specialized applications of radioisotopes are the responsibility of the clinical specialities concerned. This may well be the best arrangement for certain kinds of work. It is important, however, that in so far as this is conducive to efficiency and economy, clinical users should share facilities and equipment, and that arrangements for radiological protection should be adequately co-ordinated (especially where patients may undergo diagnosis and treatment with radiations in different departments of a hospital, in which case the total dose accumulated must always be considered before a particular procedure is undertaken). But there is no reason why some counting equipment should not be located away from the centralized radioisotope facilities,

either for assay of plasma or other samples of low activity or where a particular clinical department makes sufficient use of a procedure to justify separate facilities. However, the recommendations which follow relate for the most part to a centralized service; clearly the arrangements for work which is associated exclusively with a particular specialty will be determined primarily by the characteristics of the work.

4.4. The following are the main guide lines relating to staff which we think should influence the planning of a centralized radioisotope service. The practical application will depend on the level and complexity of the work and these recommendations should be read in association with what we say about the different types of radioisotope service in Sections 5 and 6.

4.4.1. One individual should have overall administrative responsibility for the service.

4.4.2. The responsibility for the care of a patient while undergoing any test in which radioactivity is introduced or induced into him must rest with a medically qualified person. In any service where *in vivo* studies of patients are undertaken medical staff of appropriate grades should be in attendance. Clinicians should be able to get specialized medical advice on problems arising in the interpretation of tests.

4.4.3. Physicists, biochemists, pharmacists and other scientists must participate in a service so that there is adequate advice on the principles applied in the clinical uses of radioisotopes and on radiological protection matters. However, scientists should not be employed on routine matters within the competence of a technician.

4.4.4. Technical staff should have special training for radioisotope work.

4.4.5. The person with clinical responsibility should have had special training in the clinical applications of radioisotopes to equip him for this work (see discussion of training in Section 7).

4.4.6. A service should be adequately co-ordinated with the work of other diagnostic departments. The fact that a particular category of staff is needed in a radioisotope service does not necessarily mean that the people concerned will have to work full-time there.

4.5. Full use should be made of advice and help from other departments and of secondment of their staff. While the guide lines in 4.4. give the overall staff organization, the evaluation of diagnostic information generally rests with the clinician referring the patient. But we think that, in so far as tests employing radioisotopes have common characteristics and there are pitfalls in interpretation which may be commonly encountered, there is a need for medical staff with special training and experience in these fields.

4.6. The following are guide lines which should in our view influence the planning of hospital accommodation for radioisotope services, and we recommend that the Department of Health and Social Security should have regard to them as far as practicable when building notes are revised. Here again, our recommendations should be read in association with our more specific proposals in Sections 5 and 6.

4.6.1. Adequate shielding from any sources of radiation which might impair the working of sensitive instruments should be provided (this should present no great problem even if the service is associated with a radiology department). This will be easier if the accommodation is in a cul-de-sac from the point of view of traffic within the hospital so that routes along which radio-

active sources may be carried and routes between theatres and wards do not pass near it.

4.6.2. The accommodation should be near to a point where supplies can be delivered by motor transport so that radiopharmaceuticals in heavy containers do not have to be carried long distances.

4.6.3. There should be access to a radioactivity decay store (not however so near to the accommodation for the radioisotope service that the radiation emitted in the store interferes with its work).

4.6.4. The accommodation should be near the route of a main sewer.

4.6.5. The accommodation should be easily accessible from both the outpatient department and the wards, with no stairs or steps which would impede the movement of patients on trolleys or in wheelchairs.

4.6.6. There should be appropriate provision for the care of patients, and some beds may be necessary when radioisotopes are being used for therapeutic purposes or when prolonged investigations are undertaken. (See Sections 4 and 5 of *the Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use*).

5. The Regional radioisotope centres

5.1. We have indicated in Section 3 the functions of a Regional centre as we see them. These functions are threefold:

First, the local provision of comprehensive services (both highly specialized and routine), second, the training of staff, and third, participation in the regional planning and organization of other radioisotope services.

5.2. We think that these functions can best be discharged by a Department of Nuclear Medicine ordinarily headed by a medical consultant with special interest in this field. We consider that both the volume and complexity of a Regional centre's work, and the need for medical orientation in work directed towards the development of new tests and techniques, will call for a separate department under medical control.

5.3. At this level of work the co-operation of physicists is of particular importance. Because of the special place of physics in the development of radioisotopes we consider that there should also be physicists with special interest in this field working full-time in a Department of Nuclear Medicine; where there is a Regional Hospital Physics Service, they might well be seconded from this department.

5.4. It is also important to have biochemists and pharmacists working in a Department of Nuclear Medicine and the need for their services will probably justify employing them full-time; like the physicists, they could well be seconded from their parent departments.

5.5. We consider a Regional centre to be the proper place for the practical training of staff of all kinds—doctors, scientists, nurses and technicians—in specialized radioisotope work. The function will be reflected in the numbers and composition of the staff. We suggest that the establishment of the consultant directing a Department of Nuclear Medicine should sometimes include a senior registrar for training in this department as part of his general training in medicine. The tenure of such a post should be one of the accepted means of gaining experience for future consultants taking responsibilities in such departments or in radioisotope applications in their own fields of work.

5.6. Thirteen of the hospitals which replied to our questionnaire (see Section 1) had departments which appeared to us to correspond generally to a Regional centre as we have delineated it. They are Addenbrooke's Hospital (Cambridge), Velindre Hospital (Cardiff), Leeds General Infirmary, The Liverpool Clinic, Christie Hospital and Holt Radium Institute (Manchester), Sheffield Royal Infirmary, The Royal South Hants Hospital (Southampton), Hammersmith Hospital, The London Hospital, The Middlesex Hospital, Royal Marsden Hospital, St. Bartholomew's, and University College Hospital. The average of the population said to be served by the departments outside London was 2·4 millions (the median figure was 1·75 millions). Some of the London hospitals mentioned that many of their patients were from other parts of the country or from abroad, and it was not possible to produce meaningful figures for the population served. There was considerable variation in the pattern of staffing, particularly as between the London teaching hospitals and the hospitals outside London. The former had on average a greater complement of physicists and technicians (3·6 and 6·8 respectively as against 2·4 and 4·7 for the hospitals outside London) while the latter had more medical staff (1·7 as against 1·1 for the London hospitals). Only a few hospitals gave a figure for biochemists.

5.7. We consider that the general pattern of staffing in the London hospitals is better fitted than that of the hospitals outside London for the needs of a Regional centre and gives a reasonable guide to the proportions of the various kinds of staff which will be required, although for the full work-load of a Regional centre the numbers of all these staffs will need to be increased. As we have said in paragraph 4, we think that a Regional radioisotope centre will invariably need biochemical and pharmaceutical support. Ultimately, the numbers of staff must be determined by the quantity and nature of the work, but the staffing pattern of the London teaching hospitals seems to us to provide a reasonable starting point. Obviously, there must also be adequate nursing, secretarial and ancillary staff. Training posts for staff of all kinds should be supernumerary to the establishment.

5.8. We do not think that the service functions of a Department of Nuclear Medicine can or should be sharply separated from its research and teaching functions. In a teaching hospital some of the staff might be university appointed.

5.9. In Section 6 (see below) we divide the work of a hospital radioisotope service into the five main categories of scanning, organ uptake, dynamic studies, sample counting and therapeutic applications. This broad classification is also relevant to a Regional centre (the latter will also be able to carry out whole body tests which would not necessarily be undertaken by a district service). It would not, in our view, be realistic to make detailed recommendations on the equipment needed by a Regional centre; the precise need will vary from one centre to another. Clearly, the need for equipment will be defined by the nature of the work, which in a Regional centre will have an emphasis on research and development. For many purposes automated and multichannel equipment will be required. Often, items of equipment which are basically intended for work of a routine kind will need special refinement for operation in a Regional centre. It is important that there should be access to computing facilities. There must be adequate handling facilities to cope with the relatively high levels of radioactivity which will have to be used in a Regional centre.

5.10. It may well be economically advantageous for a Regional centre to carry out some *in vitro* testing for all the hospitals in its region (as is already done in

the case of pathology) and further equipment will be needed for this purpose.
5.11. Where equipment—especially electronic equipment—of an advanced kind is used, it is most important that there should be competent people permanently available to undertake maintenance. Here also there may be advantages in a centralized service for a whole region.
5.12. The accommodation provided for a Regional centre will have to meet the varied need of work involving radioactivity at different levels and of the administration of the services provided. To a large extent the accommodation requirement will be determined by the equipment which the centre has and, clearly, precise recommendations cannot be made for the one any more than for the other. Possibly the total amount of space needed will be a minimum of 6,000 sq. ft. gross. There may well be scope for sharing facilities with university clinical departments. It should be noted that patients undergoing certain kinds of investigation will have to stay in the hospital and that there should be special provision for them in wards.

6. Services in the District general hospitals and the smaller hospitals

6.1. In Section 4 we have given certain criteria for the organization of centralized radioisotope services in hospitals. The underlying themes are the provision of a good service to the clinician, efficiency in its operation and adequate safeguards for the patient. Our concern in this section is to consider how these criteria can be met in the context of a District general hospital.
6.2. We do not think that the level and quantity of radioisotope work in the average District general hospital will justify establishing a separate department concerned with nothing else. The first question therefore is the allocation of responsibility for the radioisotope service. The decision about which individual should have overall responsibility will have to be taken locally and will depend, *inter alia*, on the degree of development of the various clinical and service departments and on the character of the radioisotope service. In these hospitals it will be necessary to define areas of administrative responsibility. In view of the importance of laboratory work in this kind of service, we think that there will be a strong case for giving overall responsibility either to the head of the department of pathology or to one of its specialized departments, e.g., biochemistry or haematology. Other possibilities are for the service to be the responsibility of the head of the departments of diagnostic radiology, radiotherapy or medical physics. Expertise in laboratory work is needed as well as daily clinical responsibility for patients. It is possible that the person designated as head of a District hospital radioisotope service may not be in a position to take clinical responsibility for the patients, and it will then be necessary to make arrangements for appropriate supervision by a clinical consultant. Medically qualified supervision of *in vivo* tests and medical advice on their interpretation will be required. Close liaison with other departments is necessary. Where overall responsibility lies with the pathologist, close liaison with, for example, the radiologist will be necessary where organ scanning is concerned. Where overall responsibility lies with the physicist or radiologist, adequate cover should be arranged for the biochemical and haematological aspects.
6.3. In considering the numbers of staff needed we have again had in mind the replies to our questionnaire. Eight of the radioisotope departments about which we received replies appeared to us to correspond generally to what we have

depicted in this and the preceding section as a District general hospital service. These are the departments at Barnet General Hospital, Derby Royal Infirmary, Hull Royal Infirmary, Kent and Canterbury Hospital, Lewisham Hospital, Nottingham General Hospital, Plymouth General Hospital, and Southend-on-Sea General Hospital (the last named including an associated service at Billericay). The population which the hospitals concerned said was served by these departments averaged 550,000 (the median was 480,000). This is somewhat higher than the population which is expected to be served by the average District general hospital but, in view of the expansion we foresee in the use of radioisotopes, we think that the provision made in these departments gives some sort of guide to the staffing which may be appropriate for a radioisotope service at district level.

6.4. However, the replies do not give any precise guide. The numbers of doctors, scientists and technicians varied greatly from department to department. (In the case of doctors and physicists this was generally one individual working part-time; the variation was in the proportion of time spent in radioisotope work.) Where an individual spends a fairly small proportion of his time in a particular activity, it may be difficult to quantify it exactly and this probably introduces an element of unreliability into the figures. However, the guide lines which we think can be inferred as to the numbers of staff needed are as follows:

6.4.1. One or more consultants, part-time, and, according to their interests, other medical staff (also part-time) to advise on the interpretation of tests and to supervise the administration of radioisotopes and the general management of patients in *in vivo* testing (see paragraphs 4.4 and 4.5).

6.4.2. One physicist, part-time. Where a District general hospital does not have its own medical physics department he would be a locally based representative of the Regional Department of Medical Physics. (The actual amount of physicists' time shown in the replies varied greatly; we suspect that there is scope for specially trained technicians to take over some work now done by physicists.)

6.4.3. One biochemist, part-time.

6.4.4. One pharmacist, part-time.

6.4.5. From one to three technicians.

6.4.6. Nursing staff as required.

6.4.7. Ancillary staff as necessary.

6.4.8. Secretarial staff as necessary (unless secretarial services are provided from the department having overall responsibility for the service).

6.5. The equipment and accommodation needed by a District hospital service will be determined by its functions. The function of a radioisotope service of this type can be divided broadly into:

6.5.1. Scanning.

6.5.2. Organ uptake (including thyroid work).

6.5.3. Dynamic studies.

6.5.4. Sample counting.

6.5.5. In some cases, therapeutic applications.

The basic items or types of specialized equipment needed will thus be scanning equipment, an uptake counter, a multiple counter for dynamic studies and a sample counter. The precise requirement would be determined by the type and quantity of work done. Of course apart from the items mentioned, the normal equipment of any radiation laboratory would also be needed.

6.6. The accommodation for a District hospital service will have to include a tracer laboratory, a physics room, clinical examination rooms, counting rooms, a dark room, a scanning room, and storage and laboratory space. This is in addition to the basic requirements of any hospital department. The total number of rooms and the overall space requirement will be determined by the nature and quantity of the work (there should also be adequate allowance for future development). As with a Regional centre, it is not possible to say in the abstract how much space will be needed; this can only be determined for a particular department and after full study of design and organization. If the accommodation for a radioisotope service is planned as part of a pathology department (see paragraph 6.2) a good deal of the general accommodation, i.e. non-laboratory, could be available to it. If a service is planned as a department on its own we think that the total space needed, if it is to perform its function adequately, will be of the order of 3,000 sq. ft. Whichever of the possible alternatives is adopted, it will be an advantage to have the isotope laboratories, the pathology department, and the diagnositc X-ray department, in close proximity for ease of access and co-operation between them.

6.7. We think that our tentative suggestions as to the equipment and accommodation needed for a District hospital radioisotope service allow for a substantially greater number of tests, in relation to the population likely to be served, than is performed at present and that provision of this order will therefore allow for future expansion. In considering what further expansion may be needed, it should be remembered that for some tests automation is likely to increase greatly the amount of work capable of being performed with a particular item of equipment and, therefore, to reduce the accommodation needed to provide for that amount of work.

6.8. Under the *Code of Practice* radiological protection must be the responsibility of the hospital authority and of the radiological safety committee appointed by it. A radioisotope service should fit into the ordinary radiological safety organization of a hospital, Under Section 2.1.3 of the Code a physicist must act as radiological protection adviser. The radiological safety officer for the purposes of Section 2.1.4 of the Code might well be one of the whole-time technicians in the radioisotope service concerned.

6.9. Many of the principles which we have suggested for a district hospital service will also be relevant to a radioisotope service ina smaller hospital but their application will depend on the nature of the work undertaken. In general we would expect the service at this level to be restricted to the simpler laboratory tests with, if the position of the medical specialities warranted it, the possible addition of some scanning procedures. It seems most likely that such a service will be part of an existing service department already enjoying appropriate technical support, and that specialists in appropriate service departments will assist clinicians with the interpretation of tests. (To take one practical example, experience in neurological centres has shown the undoubted advantages of having brain scanning associated with neuro-radiology).

7. Staff training

7.1. It would not be appropriate in a report of this kind to attempt to specify in detail the training needed for radioisotope work. However, we think it important

to state the general objectives of training and, in particular, its relationship to training for other kinds of medical, nursing and technical work.

7.2. We think it would be wrong for training to aim at creating too narrow a specialty in radioisotope work. In addition to providing the small number of doctors who will eventually become consultants in charge of a radioisotope service, training in this particular areas should be seen as part of the wider postgraduate training for work in medicine and surgery.

7.3. The aim of the specialized training in a Regional radioisotope centre should be to impart and develop those skills which are particularly relevant to medical work with radioisotopes.

7.4. The need for a broadly-based pattern of training can only be satisfied if specialized on-the-job training in Regional radioisotope centres is related to other kinds of training in the same general field. A Regional radioisotope centre should not undertake training in those aspects of the work which can be dealt with better as a part of more general basic training. Programmes of training should be planned in co-operation with other agencies responsible for training in the service and with universities and technical colleges.

7.5. At present training at all levels is inadequate and we recommend that particular consideration should be given to this probelm. Perhaps the development of a Special M.Sc. degree or a diploma would help meet the need for formal training?

8. Purchase and distribution of radioisotopes

8.1. We have mentioned in Section 3 and 4 the economic advantages to be had from bulk purchasing of radioisotopes. We think that a Regional radioisotope centre should, where possible, undertake the ordering, dispensing and distribution of radioisotopes for the District hospital services in its region; the exception is where a district service is using radioisotopes on such a scale that it is able to purchase in bulk and is associated with a medical physics department well enough developed to be able to undertake the sub-division of bulk purchases into individual doses.

8.2. The sub-division of bulk purchases into individual doses is a highly specialized and potentially hazardous task. To ensure accuracy and safety in the dispensing of radioisotopes, it is important to have a well equipped laboratory with appropriately trained technical staff and scientific supervision. A laboratory of this kind can handle a considerable volume of work.

8.3. The transport of radioisotopes is controlled by regulations which must be strictly observed. Arrangements for transport between a Regional radioisotope centre and the associated district services should be organised by the Regional centre. Where the Regional radioisotope centre undertakes the ordering, dispensing and distribution of radioisotopes, an adequate transport service is necessary.

Printed in England for Her Majesty's Stationery Office
by Ebenezer Baylis and Son Ltd., The Trinity Press, Worcester, and London
Dd158143 K12 8/70

THE ROYAL SOCIETY

FOR THE PROMOTION

OF HEALTH

90, BUCKINGHAM PALACE ROAD, LONDON, S.W.1

Borrowers must comply with the following by-laws governing the Library, made by the Council of the Society.

Books, periodicals and pamphlets may be borrowed by Honorary Fellows, Fellows, Members, Licentiate Members, Associate Members and Affiliates personally or by a messenger producing a written order. The person to whom such publications are delivered shall sign a receipt for them in a book provided for that purpose.

Publications may be borrowed through the post, or by other means of carriage, upon a written order. The postage, or carriage of publications returned to the Society shall be defrayed by the borrower.

A borrower may not have more than three publications in his possession at one time.

A borrower will be considered liable for the value of any publication lost or damaged while on loan to him, and, if it be a single volume or part of a set, for the value of the whole work thereby rendered imperfect. Marking or writing in the publications is not permitted, and borrowers are requested to call attention to damage of this character.

Books and pamphlets may be retained for twenty-eight days. Periodicals may be retained for fourteen days. Applications for extension of the loan period must be made in writing before its expiry. No publication may be kept longer than three months.

Books and pamphlets added to the library will not be lent until after the expiry of one month from the date received. The current number of a periodical may not be borrowed.

Borrowers retaining publications longer than the time specified, and neglecting to return them when demanded, forfeit the right to borrow until they be returned, and for such further time as may be ordered by the Council.

Any borrower failing to comply with a request for the return of a publication shall be considered liable for the cost of replacing it, and the Council may, after giving due notice to him, order it to be replaced at his expense.

No publication may be reissued to the same borrower until at least seven days have elapsed after its return, neither may it be transferred by one borrower to another.

Publications may not be taken or sent out of the United Kingdom.

Publications returned through the post must be securely packed and adequately protected.

The library may be used for reference by members during the office hours of the Society.

Publications borrowed through the post must be acknowledged on the form provided, immediately upon receipt, and returned when due to the Librarian at the above address.

December, 1970.

O.B., Truro.

Published by
HER MAJESTY'S STATIONERY OFFICE

To be purchased from
49 High Holborn, London WC1
13a Castle Street, Edinburgh EH2 3AR
109 St Mary Street, Cardiff CF1 1JW
Brazennose Street, Manchester M60 8AS
50 Fairfax Street, Bristol BS1 3DE
258 Broad Street, Birmingham 1
7 Linenhall Street, Belfast BT2 8AY
or through any bookseller

SBN 11 320183 4